[0028] By determining a second travelling wave differential current, by means of adjustment of at least one of magnitude and phase of the first travelling wave differential current such that all modes attain equal or increasingly equal modal characteristics, modal domain differences in the above-mentioned propagation function may be 'filtered out' for faults occurring close to or at the (travelling wave) 'sending' line end or position. Thereby, indication of false differential currents in healthy conductors even during the worst case scenario as discussed above may be eliminated. The second travelling wave differential current may be seen as a phase domain normalized version of the first travelling wave differential current.

[0029] In a multi-conductor protected unit or transmission line, there are generally several mutually coupled phases or conductors, with one mode for each phase that is mutually coupled. Each mode may be modeled as an independent, single-phase transmission line. For unbalanced transmission lines, the modes will have different surge impedances and travel times. Usually there are two different types of modes. Firstly, there is the ground mode, or common mode or zero sequence mode. This mode is in general active whenever ground currents flow in the system. Secondly, the remaining modes are known as metallic modes, or differential modes or positive and negative sequence modes. The ground mode is normally associated with a longer travel time, lower characteristic admittance and a larger resistance than the metallic modes.

[0030] As indicated above, a false differential current in healthy conductors may appear due to the different properties of each modal propagation function. According to an example, for adjusting at least one of magnitude and phase of the first travelling wave differential current, such that all modes attain equal or increasingly equal modal characteristics, a slowest one (or one of the slowest) of the modes of the first travelling wave differential current is identified. The slowest mode may be a mode of the first travelling wave differential current which has a largest propagation delay. The slowest mode is often the ground mode. Delays and low pass functions may then be applied to all other modes of the first travelling wave differential current such that the elements of the thus determined second travelling wave differential current will have equal time delay and attenuation and/or distortion during the worst case scenario, i.e. during faults close to or at the sending line end, i.e. when the distance between receiving end and the position in which the fault occurs is the largest.

[0031] Hence, based on the first travelling wave differential current, a mode of the first travelling wave differential current having a largest propagation delay may be identified.

[0032] The adjustment of at least one of magnitude and phase of the first travelling wave differential current such that all modes attain equal or increasingly equal modal characteristics may for example be based on the propagation function for the identified mode, or the propagation function evaluated for the identified mode. For example, at least one of magnitude and phase of the first travelling wave differential current may be adjusted such that all modes attain equal or increasingly equal arrival times at the first or second position and/or evolvement as a function of time.

[0033] Identification of a mode of the first travelling wave differential current mode having a largest propagation delay based on the first travelling wave differential current may for example comprise comparing eigenvalues associated with the modes of the first travelling wave differential current. For example, magnitudes of eigenvalues associated with the modes of the first travelling wave differential current may be compared, so as to identify a mode of the first travelling wave differential current having a largest propagation delay.

[0034] According to an example, after the slowest mode (or a slowest mode) has been identified, a normalization matrix in modal domain is constructed based on a combination of the propagation function of the slowest mode and the inverse of the modal domain propagation function. The result of application of the normalization matrix to the first travelling wave differential current is a normalized differential current vector, which has been referred to in the foregoing as the second travelling wave differential current, in the elements of which a differential current will only be present in an element which corresponds to a faulty, non-healthy phase.

[0035] In the second travelling wave differential current, which in view of the foregoing description in general may be a vector, the elements may be 'filtered' by a minimum phase shift function of the identified slowest mode, and delayed by the propagation delay of the slowest mode. In general no additional delays are applied to the first travelling wave differential current, since the faulted phase may not be identified until all modes have arrived at the receiving line end or position. The delays and filters may be applied to all of the modes other than the slowest mode (or the slowest modes), such that all of the modes attain equal or substantially equal properties with respect to arrival times and/or other modal characteristics, e.g. with respect to the modes' evolvement as a function of time, during the fault.

[0036] For internal faults which may occur close to or at the receiving line end of the transmission line or protected unit, the elements of the first travelling wave differential current will in general not include any false differential current for healthy phases or conductors. However, during internal faults which may occur close to or at the sending line end of the transmission line or protected unit, elements of the first travelling wave differential current which do correspond to healthy conductors may include false differential currents.

[0037] However, in the elements of the second travelling wave differential current a differential current may only be present in an element which corresponds to a faulty, non-healthy phase in case of internal faults which may occur close to or at the sending line end of the transmission line or protected unit. This suggests, depending on the location in a transmission line or protected unit at which a fault will, or is expected to, occur, that either the first travelling wave differential current or the second travelling wave differential current should be chosen as input to a decision logic or the like which determines or assesses whether there is a fault in the transmission line or protected unit or not. The first travelling wave differential current and the second travelling wave differential current may each in a sense be considered to represent a 'boundary' of the transmission line or protected unit. Since it in general is not known at which location in a transmission line or protected unit a fault will occur, the first travelling wave differential current and the second travelling wave differential current may according to an example be combined such that indication of any false differential current for healthy conductors may be mitigated or even eliminated irrespectively of where in the transmission line or protected unit a fault occurs. The result from the